A BIOLOGICAL WARFARE DETECTION DEVICE (BIOWARD I)

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ABSTRACT

Using a bulk acoustic wave immunosensor device, Staphylococcus enterotoxin B and two simulant Biological warefare agents (bacteriophage MS-2 and bacteria *Erwinia herbicola*) could be detected in a direct fashion without the use of labelled antibodies. The detection device is incorporated into a ruggedized suit-case together with an aerosol sampler and sample handling system and can be used in the field for military monitoring purposes.

INTRODUCTION

Within the area of biological warfare there is a lack of modern biochemical sensors capable of real-time monitoring of pathogenic micro-organisms and toxins produced by them. General requirements for this type of sensors are: high sensitivity, short response times and high selectivity resulting in low false alarm rates. We here describe the development of an automated biosensor monitoring device for the detection of Staphylococcus Enterotoxin B (SEB), one of the protein toxins produced by the bacterium Staphylococcus aureus, MS-2 bacteriophage which is a simulant for a BW virus and *Erwinia herbicola* as a simulant for BW bacteria. These three agents are regarded as model agents covering a sufficiently broad spectrum.

The total system consists of an aerosol sampler, sample handling system, detection system and a PC and LCD screen for data acquisition. All subparts, which are thermostrated if necessary, are mounted in a box, which can be transported by a single person. For detection purposes three 20 MHz piezoelectric quartz crystal sensor devices are employed. Anti-BW “simulant” antibodies are coupled to the sensor surface using several interfaces. The assay is based on a direct immunological detection by anti-BW “simulant” antibodies as catching molecules.

RESULTS

By using the acoustic wave immunobiosensor system under laboratory circumstances, solutions of SEB or BW simulants could be detected in a direct fashion without the use of labelled compounds. The detection limit of the sensor for SEB was determined at 10 ng/ml. The detection limits for the simulant agents MS-2 and Erwinia herbicola were determined at 5 [x] 107 pfu and 107 cfu respectively. The sensor response is proportional to the concentration SEB or BW simulant in the samples.

After the sensor surface was cleaned by acid oxidation, an amino layer was deposited to the surface by plasma polymerisation. Antibodies directed to SEB or BW simulant were covalently bound to the amino functionilized surface [1]. Using the preconstructed interface the sensor response time for MS2 phages is approximately 10 min (Figure 1). SEB was injected as a control agent, which did not yield any response. The presented immunochemical detection principle is directly applicable to other BW agents.

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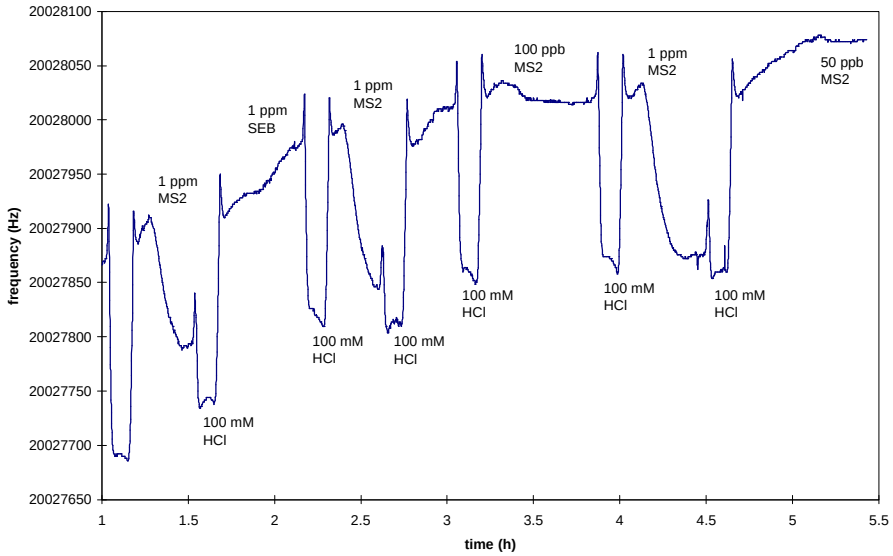

Figure 1. Sensor response of plasmapolymerised BAW crystals coated with anti-MS2 antibodies on injections of 1 µg/ml MS2 in HBS and 1 µg/ml SEB (control of specificity); 100 µl sample injection in carrier flow rate of 25 µl/min.

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